CALIFORNIA ENERGY COMMISSION

California Energy Commission Energy Efficient Natural Gas Use in Buildings Roadmap

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Stakeholder Workshop (Commercial)

Downey, California

Monday, October 14, 2013

Agenda

Focus Area: Commercial Buildings

Time	Topic
9:30 AM	Introduction and Overview
9:45 AM	Natural Gas Usage Characteristics
10:00 AM	Overview of Preliminary Research Areas
10:45 AM	Discussion Q&A
12:00 PM	Lunch
1:00 PM	Instructions for Breakout
1:15 PM	Breakout session
2:15 PM	Report-back
3:15 PM	Public Comment
4:30 PM	Closing and Next Steps

Project Overview and Workshop Objectives

Project Description and Goals

- Project started May 2013; Public draft scheduled late 2013/early 2014
- Goals:
  - Inform upcoming Natural Gas Research, Development and Demonstration Program: *Proposed Program Plan and Funding Request for Fiscal Year 2014-2015*
  - Summarize status of current technology and potential for energy savings
  - Identify what areas and technologies require research to overcome barriers

Develop a **research roadmap** for residential and commercial buildings, across all natural gas end uses based on stakeholder driven process

Project Research Completed to Date

- Baseline Investigation: Compiled past, current and new research related to natural gas energy efficiency in buildings
  - Literature review
  - Publicly available reports

- Interviews with Industry Experts
  - 43 completed interviews
  - 35 different organizations (trade, utility, non-profit, government)
  - Across different sectors and end uses

Literature Review Sources

Key Sources for Baseline Investigation of Past and Current Research*

Type	Organizations
California ratepayer funded	California Energy Commission California Public Utilities Commission Emerging Technologies Coordinating Council PG&E Food Service Technology Center Southern California Gas Company
Trade organizations	American Council for Energy Efficient Economy American Gas Association Gas Technology Institute
Federal entities	U.S. Department of Energy (DOE) National Renewable Energy Laboratory Lawrence Berkeley National Laboratory Oak Ridge National Laboratory Pacific Northwest National Laboratory

* Other sources that were investigated included the Electric Power Research Institute, Alliance to Save Energy, and New York State Energy Research & Development Authority (NYSERDA).

List of Organizations of Experts Interviewed

Affiliated International Management LLC	Gas Technology Institute
Air-conditioning, Heating & Refrigeration Institute	Harpiris
American Council for Energy Efficient Economy	Heschong Mahone Group/TRC
Balance Point Home Performance	James J. Hirsch & Associates
California Public Utilities Commission	Koeller and Company
Center for Energy and Environment	Lawrence Berkeley National Laboratory
Chitwood Energy Management, Inc.	McHugh Energy Consultants
CNT Energy	National Renewable Energy Laboratory
Colorado State University	Natural Resources Defense Council
Davis Energy Group	Oak Ridge National Laboratory
DTE Energy	Pacific Gas & Electric (PG&E)
E Source	Sempra Energy
Ecova	Taylor Engineering
Energy Solutions Center	The Benningfield Group
Enovative Group, Inc	Trane
Enovative Kontrol Systems	US Energy Information Administration (EIA)
Food Service Technology Center	

Today's Workshop Objectives

- Present research results to-date
- Obtain feedback and input on:
  - Recommendations for priority research needs to maximize natural gas energy efficiency
  - Status of energy efficiency technology development for natural gas energy efficiency
  - Problems and challenges that affect natural gas energy efficiency
  - Data and research gaps that are barriers to maximizing energy efficiency
  - Recommendations on partnership opportunities

Goal: Identify the research needed to achieve reductions in natural gas energy usage in residential and commercial buildings

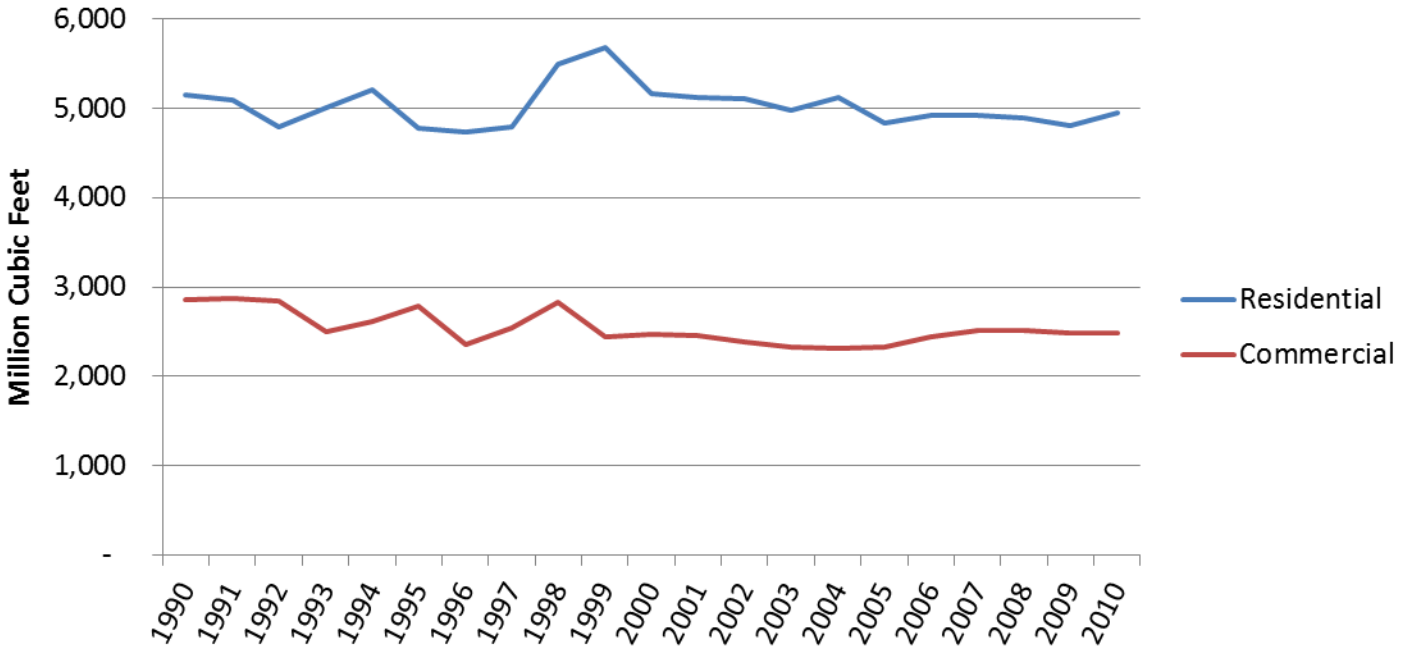
Background: Natural Gas Usage Characteristics

Commercial Buildings

- To prepare for a productive dialogue, we need to provide context
- What have been the trends of natural gas consumption?
- Which building types are the heaviest natural gas consumers?
- Which end-uses are the most intensive?
- What additional research is available and upcoming?

The next few slides will paint the natural gas landscape of California

Historic Natural Gas Consumption in California Buildings (1990-2010)



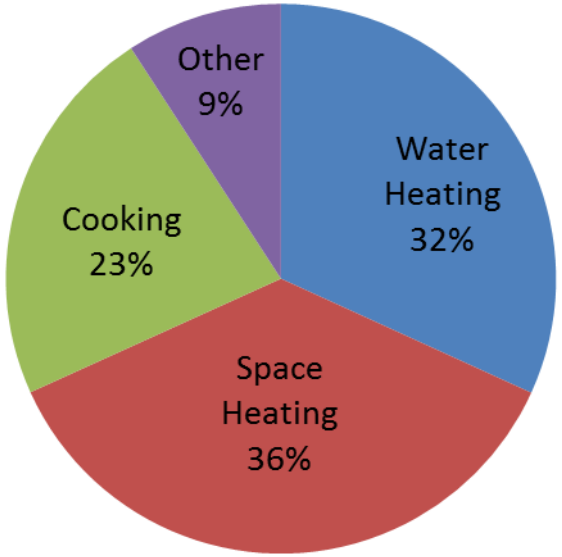
- Overall, steady natural gas consumption in both residential and commercial sectors
- In 2010, residential sector roughly double consumption of commercial sector

Source: U.S. Energy Information Administration. State Energy Data System (SEDS). June 2012.

Estimated Commercial Natural Gas Consumption by End Use (2006)

	Billion Therms/Year
Water Heating	0.80
Space Heating	0.90
Cooking	0.58
Other	0.23
TOTAL	**2.50**

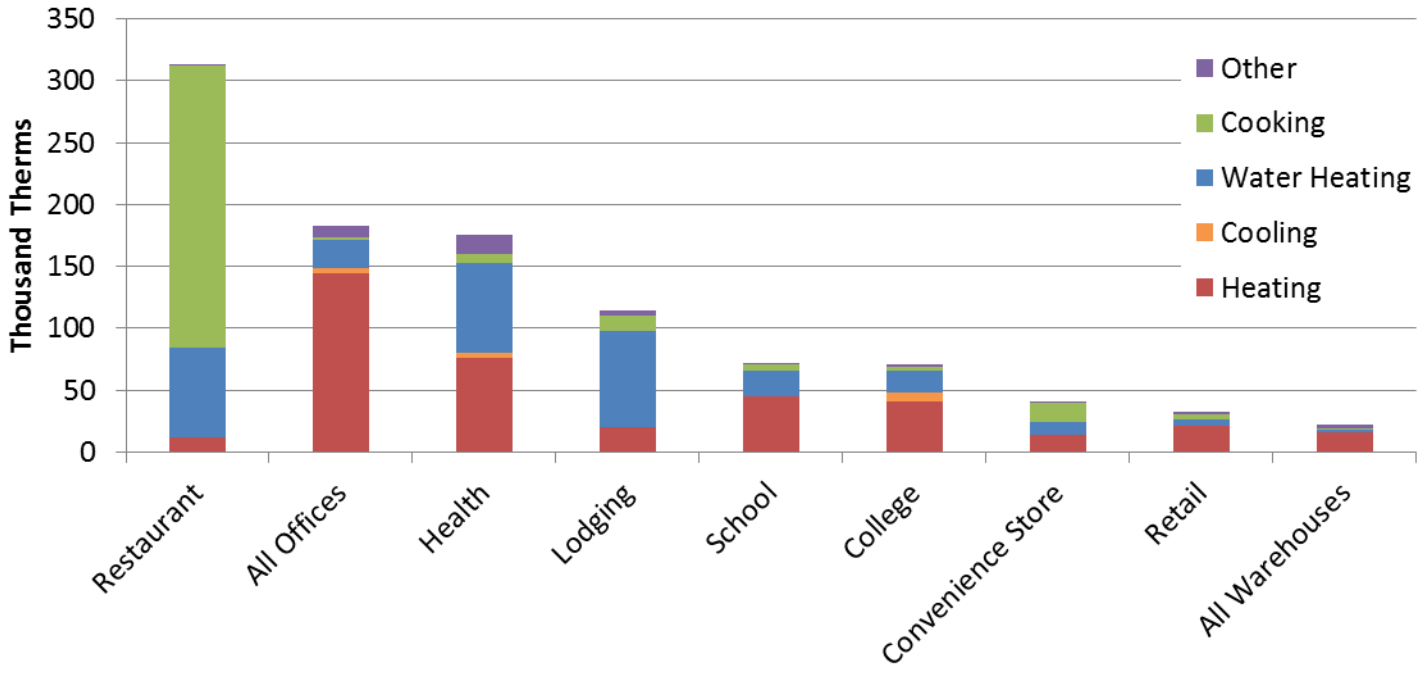
Commercial Natural Gas Consumption by End Use (2006)



- Water heating and space heating are the most intensive end uses
- Cooking, driven almost entirely by the restaurant sector, is responsible for 23% of natural gas consumption

Source: CEC California Commercial End Use Survey (CEUS) 2006

Commercial Natural Gas Consumption by End Use and Building Type in California[1] (2006)

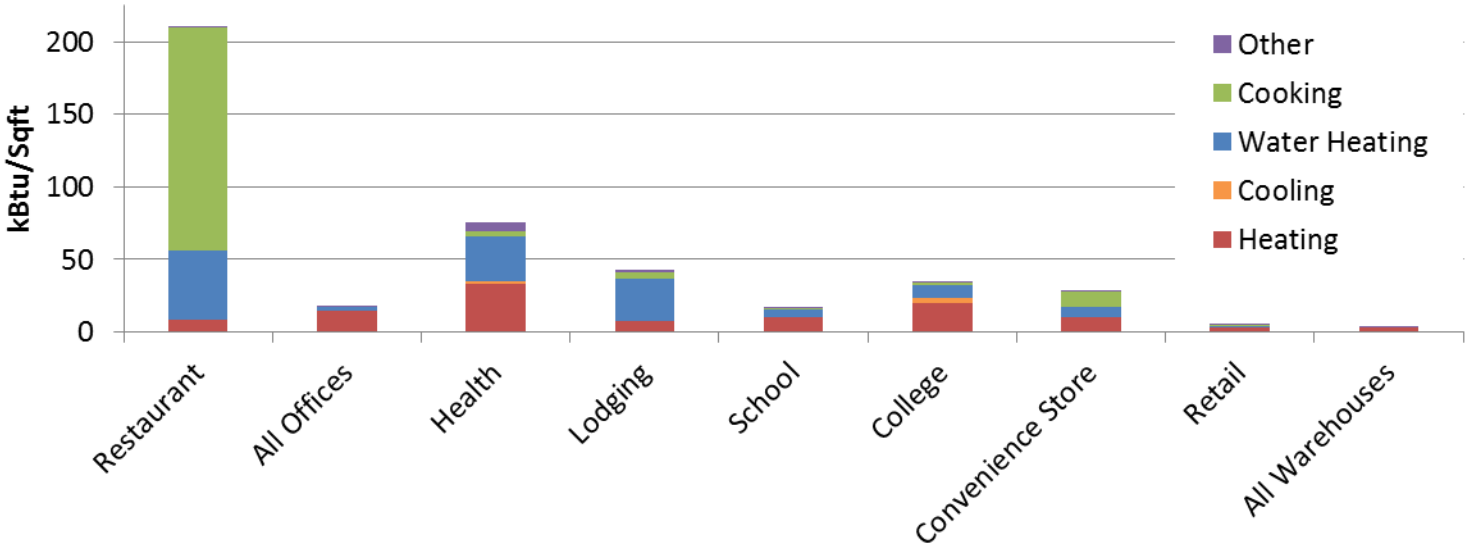


- Among building types, restaurants are the largest consumer of natural gas
- Offices, health, lodging, and schools are large consumers of natural gas, expected end-uses, water heating and space heating are most intensive

Source: CEC California Commercial End Use Survey (CEUS) 2006

[1] Data from CEUS consider homes in California that are within IOU territories, that DNV KEMA believes is a representative sample of the state.

Commercial Natural Gas Consumption per Square Foot by End Use and Building Type in California[1] (2006)



- Restaurants (cooking) more than double the intensity of any other buildings; very little space heating in restaurants
- Health, lodging are second and third most intensive building types, respectively.
- Water and space heating, expectedly, are the most intensive end uses in all building types (except restaurants)

Source: CEC California Commercial End Use Survey (CEUS) 2006

[1] Data from CEUS consider homes in California that are within IOU territories, that DNV KEMA believes is a representative sample of the state.

Additional and Upcoming Research

Commercial

- Commercial Saturation Study (incomplete) (CPUC)
- Commercial Market Share Tracking study (incomplete) (CPUC)
- Custom projects evaluation (interim report available) (CPUC)

Residential and Commercial

- Energy Efficiency Potential Study (CPUC)
- Macro Consumption Pilot Study (CPUC)
- Measure Cost Study (Incomplete) (CPUC)

Residential Only (All Incomplete)

- CLASS (CPUC)
- Whole House Retrofit Evaluation (CEC and CPUC)
- HVAC Quality Install Evaluation (CPUC)

- Water and space heating are the largest and most intensive natural gas end-uses
- Restaurants, specifically from energy-intensive cooking, are the largest consumers of natural gas
- Equipment efficiency means and saturations should be released soon

Heaviest consumers: HVAC, water heating, and cooking.
What are the opportunities for reductions?

Overview of Initial Priority Research Areas Identified to Date

Initial Priority Research Areas

- Based on interviews with 43 industry experts and literature review of 31 research initiatives
- Organized by End Use
  - Water heating
  - Space heating
  - Commercial Cooking
  - Other

Water Heating

Key findings: Largest natural gas end use, with well-documented body of research; well-organized industry initiatives

Research Recommendations

1.Develop and demonstrate high efficiency water heaters leveraging natural gas heat pump technology

- "Triple-integrated appliance" for space heating, cooling and water heating
- Heat pumps as next technology beyond maximum efficiencies achievable with condensing technology
- Demonstration projects to overcome technical issues and reduce costs

2.Develop and demonstrate cost effective waste heat recovery, including combined drain heat and greywater capture

- Waste heat from walk-in freezers (with 24 hours/ 7 days a week load)

Water Heating

Research Recommendations (continued)

3.Develop low-cost solar systems with focus on new materials (e.g., polymers)

- Ultra-low cost solar water heaters with goal selling units for $1000 or less
- Polymer materials with similar conductive properties to copper and glass

4.Support water distribution system design research

- More attention needed for systems perspective (lagging behind improvements to efficiency of heating equipment)
- Optimal configuration of piping and alternatives to recirculation systems

5.Collect and characterize energy use related to water heating across different building types, designs and vintages.

- By building type, vintage and consumption (fixtures)
- Real-world data on water system design
- Data needed to update uniform plumbing code

Space Heating

Key findings: Condensing furnace technology lagging in commercial sector relative to residential.

Research Recommendations

1.Develop and demonstrate cost effective roof-top condensing furnaces for commercial applications

- "Final frontier for condensing gas heating equipment"
- Best practices associated with installing condensing rooftop units

2.More research related to natural gas heat pump technologies and combined space heating and water heating technologies

- Historically poorly installed; need to aggregate more recent research and data
- Demonstration projects to show lifecycle payback

Space Heating

Research Recommendations (continued)

3.Support research to improve efficiency of ductwork, including duct sealing and moving ducts into conditioned space

- Duct sealing to focus on the most significant leaks and new construction practices
- Duct right-sizing and ducts in conditioned space

4. Conduct more research related to controls for both individual equipment, as well as whole building

- Optimize controls and add-on controls for rooftop units
- Develop new standard sequences in controls software, real-time controls

Commercial Cooking

Key findings: Cooking equipment notoriously inefficient (e.g., 45-50% efficiency to qualify for ENERGY STAR). Bifurcated residential and commercial market for cooking equipment. Commercial cooking equipment is a commodity product.

Research Recommendations

1.Focus on developing economy-grade ENERGY STAR cooking appliances

- High-end ENERGY STAR cooking appliances have extra features
- Particular need for economy-grade ENERGY STAR models for well-established categories such as ovens, fryers and steamers that provide same level of performance and reliability as high end units
- Research technical and market barriers

2.Focus on reducing standby energy and idle rates, including use of insulation, controls, temperature setback, lids and multi-stage burners

- Equipment needs to be ready for customers who come in at any time
- Energy loss impacts the overall efficiency of equipment
- Huge opportunity to increase efficiency

Commercial Cooking

Research Recommendations (continued)

3.Support product development for select appliance types

- Equipment such as turbo pot, lidded charbroiler and lidded griddles
- Proof of concept completed for these (restaurant operators use them in a way that actually reduces natural gas use)
- Technology and products needs refinement

4.Support research related to "smart" or "intelligent" kitchens

- More research on cost-effectiveness and potential savings
- Improve tracking systems for when and where gas is being consumed

Other

Key findings: Remaining recommendations that cover other end uses or whole buildings

Research Recommendations

1.Support development of more efficient gas dryers

- ENERGY STAR standard underway, including test procedures
- Research exhaust heat recovery to pre-heat air coming into the dryer
- Better insulated dryers and automatic termination

2.Conduct study of economic and technical potential for heat recovery

- Research to identify overall potential for cost effective waste heat recovery from all sources including refrigeration, kitchen exhaust, drain water, etc.
- Identify areas to focus on and develop a roadmap for synergies between different technological opportunities

Other

Research Recommendations (continued)

3.Develop additional efficiency rating systems for combined space and water heating systems

- Move away from two combustion sources (e.g., water heater and furnace)
- Rating method to help market understand the value of these products
- Build a standard for a product that is not yet regulated.\

4. Additional research for reduced air emissions related to burners while increasing energy efficiency

- NOx controls for new energy efficient equipment
- Challenges increasing system efficiency while reducing cost and NOx

Discussion and Q&A

Lunch

Meet back here afterwards.

Instructions for Breakout Sessions

Breakout Sessions: Downey, CA

Topic	Location	Facilitator
Water heating	Multi-purpose room	Rachel Schiff
Space heating/cooling	Combustion demo	Jon Taffel
Cooking	Climate control	Jarred Metoyer

1. Review initial priority research areas
   a) What is the status of technology development?
   b) What are specific tasks and next steps? (3-5 actions)
   c) What are partnership opportunities?
2. Identify what research areas may be missing as priorities
   a) What problems or challenges need to be overcome?

Designate someone to report back to the group. Meet back here at 3:15 PM

Breakout Session Report Back

Final Public Comments

Next Steps: Prepare a Roadmap

- Prepare draft roadmap
- Research initiative descriptions that include:
  - An initiative description, including areas of potential applied research/demonstration
  - Clear issue statement
  - Status of past research
  - Policy context and justification
  - Estimated baseline natural gas use to be affected
  - Estimated natural gas savings and co-benefits
  - List of research beneficiaries by location
  - Tasks required for realizing full potential
  - Barriers to full potential and how research helps

Contacts

Please send any additional written comments by Monday 10/21 COB

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